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IS 3885-1 (1992): Steel for the manufacture of laminated springs (railway rolling stock) Part 1 Flat Sections [MTD 4: Wrought Steel Products]

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IS 3885 (Part 1) : 1992

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पटलित कमानी (रेल डिब्बे) के निर्माण के लिए इंप्रात

भाग 1 फ्लैट सेक्शन — विशिष्ट

Indian Standard

STEEL FOR THE MANUFACTURE OF
LAMINATED SPRINGS (RAILWAY
ROLLING STOCK)

PART 1 FLAT SECTIONS — SPECIFICATION

(*Second Revision*)

UDC 669.14 - 41 : 621 - 272.3 : 625.2

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1966 and then revised in 1977. In the light of further experience gained with the usage of this standard, it has been decided to revise it with the following modifications have been made.

- a) Secondary refining or secondary vacuum melting shall be adopted while manufacturing steel.
- b) Minimum reduction ratio has been modified to 16 : 1 in place of 10 : 1.
- c) Depth of the decarburization (partial plus complete) has been incorporated.

Only the flat sections are covered in Part 1 of the standard. Rib and groove sections are covered in IS 3885 (Part 2) : 1990 'Specification for steel for manufacture of laminated springs (railway rolling stock) : Part 2 Rib and groove sections (second revision)'.

In the preparation of this standard, the Sectional Committee kept in view the manufacturing and trade practices followed in the country in this field. Furthermore, due consideration has also been given to the need for international co-ordination among standards being followed in various countries of the world. These considerations led the Sectional Committee to derive assistance from the following standards:

IRS M 10-65 Carbon spring steel for laminated springs Ministry of Railway, Government of India.

IRS M 11-65 Silico manganese springs steel (for laminated springs). Ministry of Railways, Government of India.

BS 24 Part 3A : 1959 Laminated springs for spring steel. British Standards Institution.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised).' The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**AMENDMENT NO. 1 JANUARY 1995
TO
IS 3885 (Part 1) : 1992 STEEL FOR THE
MANUFACTURE OF LAMINATED SPRINGS (RAILWAY
ROLLING STOCK)**

PART 1 FLAT SECTIONS — SPECIFICATION

(Second Revision)

(Page 2, Table 1, Grades 3 and 4, col 7 and 8, headed under Sulphur and Phosphorus, Max) — Substitute '0.030' for '0.050'.

(Page 2, clause 9.1, line 2) — Substitute '2.0' for '2.5'.

(Page 4, clause 15.1) — Substitute the following for the existing clause:

“15.1 The material shall be supplied in ‘as rolled’ condition.”

(MTD 4)

Reprography Unit, BIS, New Delhi, India

*Indian Standard***STEEL FOR THE MANUFACTURE OF
LAMINATED SPRINGS (RAILWAY
ROLLING STOCK)****PART 1 FLAT SECTIONS — SPECIFICATION***(Second Revision)***1 SCOPE**

1.1 This standard covers the requirements for hot-rolled steel flats intended to be used for the manufacture of laminated springs for railway rolling stock.

1.2 Steel ingots, billets and blooms conforming to IS 8052 : 1990 may be used for the production of steel flats conforming to this Indian Standard.

2 REFERENCES

The standards listed below are necessary adjuncts to this standard:

IS No.	Title
228	Methods of chemical analysis of steel (<i>second revision</i>)
1500 : 1983	Brinell hardness for metallic materials
4163 : 1982	Method for determination of inclusion content in steel by microscopic method
6396 : 1983	Method of measuring decarburized depth of steel
8052 : 1990	Steel ingots, billets and blooms for the production of volute, helical and laminated springs (railway rolling stock) (<i>first revision</i>)
8910 : 1978	General technical delivery requirements for steel and steel products.

3 GRADES

Steel shall be of four grades as specified in Table 1.

4 SUPPLY OF MATERIAL

General requirements relating to the supply of material shall conform to IS 8910 : 1978.

5 MANUFACTURE

5.1 Steel shall be manufactured by any process of steel making except the bessemer process. It shall be followed by secondary refining or secondary vacuum melting.

5.2 The size of ingot, billet or continuous cast billet for any given size of finished steel pro-

ducts shall be such that a minimum reduction ratio of 16:1 from the minimum cross-sectional area of the ingot, billet or continuous cast billet to the maximum cross-sectional area of the product is ensured. However reduction ratio other than that specified may be agreed subject to mutual agreement between the purchaser and manufacturer.

6 CHEMICAL COMPOSITION

6.1 The ladle analysis of the steel, when carried out by the method specified in the relevant parts of IS 228 or any other established instrumental/chemical method shall be as given in Table 1. In case of dispute the procedure given in relevant parts of IS 228 shall be the referee method. However when the method is not given in IS 228 and its relevant parts the referee method shall be as agreed to between the purchaser and the manufacturer.

6.2 Incidental Elements

Elements not quoted in Table 1 shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition from scrap or other materials used in manufacture of such elements which effect the hardenability, mechanical properties and applicability.

6.3 Product Analysis

The permissible variation in the case of product analysis, from the limits specified in Table 1 shall be as follows:

Constituent	Permissible Variation Over Specified Limit Percent
Carbon	± 0.03
Manganese	± 0.04
Silicon (Up to and including 0.35) (Above 0.35)	± 0.03 ± 0.05
Sulphur	$+ 0.005$
Phosphorous	$+ 0.005$

NOTE — Variations shall not be applicable both over and under the specified limits in several determinations in a heat.

Table 1 Chemical Composition
(*Clauses 3.1 and 6.1*)

Grade	Designation [see IS 1762 (Part 1) : 1974]	Type	Constituent, Percent				
			Carbon	Silicon	Manganese	Sulphur	Phosphorous
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	55C6	Water-hardening	0.50 to 0.60	0.15 to 0.35	0.50 to 0.65	0.050	0.050
2	75C6	Oil-hardening	0.70 to 0.80	0.15 to 0.35	0.50 to 0.80	0.050	0.050
3	40Si7	Water-hardening	0.35 to 0.45	1.50 to 2.00	0.80 to 1.00	0.050	0.050
4	55Si7	Oil-hardening	0.50 to 0.60	1.50 to 2.00	0.80 to 1.00	0.050	0.050

7 HARDNESS

7.1 The hardness of the material when tested in accordance with IS 1500 : 1983, shall be as given in Table 2.

Table 2 Brinell Hardness
(*Clause 7.1*)

Grade	Hardness, HBS	
	Untreated Condition (For guidance only)	Annealed Condition Max
(1)	(2)	(3)
55C6	—	240
75C6	—	240
40Si7	≥ 270	245
55Si7	≥ 270	245

7.1.1 In case of as-rolled material, the limits for hardness other than those given in Table 2, may be mutually agreed upon at the time of enquiry and order.

8 DECARBURIZATION

8.1 Complete Decarburised Depth

Complete decarburized depth is the depth measured at right angles to the surface of the zone which contains at least 90 percent ferrite.

8.2 Partial Decarburised Depth

Partial Decarburised Depth is the depth measured at right angles to the surface of the zone which contains less carbon than the general carbon content of the core. The limit of this zone is the point where a micro-structural change between the surface and the core is apparent.

8.3 Total Decarburized Depth

Total decarburized depth is the sum of the complete and Partial Decarburized Depths.

8.4 The average total depth of the decarburization (Partial plus complete) of five deepest uniformly decarburized zones shall not exceed 1.5 percent of the thickness of flats. The decarburization shall be examined at X 100 magnification on a test specimen suitably etched

and cut from a full cross-section of the test bar showing at least 25 mm of the original perimeter as per IS 6396 : 1983.

Note — Points of extreme depth of decarburization shall not be excluded.

9 INCLUSION RATING

9.1 The inclusion rating when determined as per IS 4163 : 1982 shall not be worse than 2.5 A, B, C, D both for thick and thin series given in Fig. 2 of IS 4163 : 1982.

10 FREEDOM FROM DEFECTS

10.1 The hot-rolled material shall be free from harmful defects, namely, seams, folds, laps, cracks, deep pits, grooves, excessive scaling, etc, which may lead to cracking during hardening or impair serviceability. The surface shall be reasonably smooth and free from distortion, twists and kinks. Unless otherwise agreed to between the purchaser and the manufacturer, out of straightness to the extent of 7 mm per 2 m length shall be accepted.

10.2 The depth of the seams and laps in the longitudinal direction shall be 2 percent *Max* of the section thickness. There should be no defect in the transverse direction.

11 ROLLING TOLERANCES

11.1 The Rolling tolerances on width shall be as given in Table 3.

Table 3 Rolling Tolerance on Width

(Clause 11.1)

All dimensions in millimetres.

Nominal Width	Tolerance
Up to and including 50	± 0.30
Over 50 up to and including 63	± 0.38
Over 63 up to and including 75	± 0.45
Over 75 up to and including 90	± 0.54
Over 90 up to and including 120	± 0.60
Over 120 up to and including 125	± 0.62
Over 125 up to and including 140	± 0.70
Over 140 up to and including 150	± 0.75

11.2 Tolerance on Thickness

The rolling tolerance on thickness shall be as given in Table 4.

Table 4 Rolling Tolerances on Thickness
(Clause 11.2)

All dimensions in millimetres.

Thickness	Tolerance
Up to and including 10	± 0.15
Over 10 up to and including 16	± 0.20
Over 16 up to and including 20	± 0.25

11.3 Neither of the broad faces of any section shall be convexed transversely. The total reduction in thickness between the outer edges and the middle of the flat due to concavity of either or both broad faces shall not exceed the limits shown in Table 5.

Table 5 Permissible Concavity
(Clause 11.3)

Width of Flat	Permissible Maximum Concavity measured on one Flat Side with a Filler Gauge
Over	Up to and including
—	75
75	100
100	125
125	150

11.4 The surface shall be rectangular with radioused edge; the edge radii shall normally be approximately equal to thickness of the material. Material having other edge radii may be supplied subject to agreement between customer and supplier. The standard sections are given at Table 6.

12 CAMBERING TEST

12.1 One test specimen from each cast or from each delivery of less than one cast, shall be selected and tested in the presence of purchaser or his representative.

12.2 Each test piece shall have a length of $60 a$ where a is the thickness of the test piece. It shall be cambered to a radius of $80 a$ and then suitably hardened and tempered so as to obtain

Table 6 Standard Sections of Flat

(Clause 11.4)

All dimensions in millimetres.

Width (1)	Thickness (2)	Width (1)	Thickness (2)
50	10	100	10
50	13	100	11
63	6	100	13
63	8	100	16
63	10	100	19
63	11	115	10
63	13	115	11
75	6	115	13
75	8	115	16
75	10	115	19
75	11	120	16
75	13	120	19
75	16	125	10
90	6	125	13
90	8	125	16
90	10	140	11
90	11	140	13
90	13	150	11
90	16	150	13
90	19	150	16
100	8		

hardness value in the range of 376 to 421 HB. The required camber shall be $5.5 a$ and any adjustment of the camber which may be necessary, shall be made at the tempering temperature. The cambered test piece shall be pressed straight once between two straight parallel surfaces and the camber, after release of the load, shall be not less than $5 a$. The test piece shall then be pressed straight six times in quick succession and shall then show no further permanent set. The calculated values for the dimensions specified are given in Table 7.

12.3 Should a test piece first selected by the purchaser or his representative not fulfil the test requirements specified in clause 12.2 two further test pieces shall be taken, one of which shall be from the original bar, unless this has been withdrawn by the manufacturer. Should either of these further test pieces fail, the material represented shall be deemed not to comply with this Indian Standard.

Table 7 Calculated Values of Dimensions

(Clause 12.2)

All dimensions in millimetres.

	Thickness of Flat, a							
	6	8	10	11	13	14	16	19
Length of test piece, $60 a$	360	480	600	660	780	840	960	1140
Initial camber, $5.5 a$	33	44	55	60.5	71.5	77	88	104.5
Minimum camber after test pressing and next six consecutive pressing, $5 a$	30	40	50	55	65	70	80	95

CALCULATION OF MASS

The mass of the material shall be calculated on the basis that the steel weighs 7.85 g/cm³.

14 SAMPLING

14.1 Chemical Analysis

One bar for every 20 tonnes or part thereof the material from the same cast shall be analysed for product analysis. The analysis results obtained shall meet the requirements of product analysis as stipulated in 6.

14.2 Hardness Test

Two percent of the bars of the same section and cast shall be tested for brinell hardness. The average of three readings for hardness shall comply with requirements given in Table 2.

14.3 Dimensional Check

Three percent of bars selected at random shall be checked for conformity with the requirement of dimensions and tolerances as specified in 11.1 to 11.4.

14.4 Decarburization

Two percent of the bars (by number) of the same section and if annealed two percent from each annealing batch (by number), selected at random, shall be tested for decarburization.

14.5 Inclusion Rating

Two sample of the same section and cast, selected at random, shall be tested for inclusion rating.

15 DELIVERY

15.1 The material shall be supplied in any one of the following conditions, subject to mutual

agreement between the purchaser and the manufacturer:

- a) As rolled; and
- b) As rolled and annealed.

15.2 The material may also be supplied in shot or sand-blasted conditions if agreed to between the purchaser and the manufacturer.

15.3 The surface of the material may be coated with a thin layer of anti-rust oil, or anti-rust compound when agreed to between the purchaser and the manufacturer.

16 MARKING

16.1 Each flat shall be stamped with the name or trade-mark of the manufacturer, grade and cast number or by such identification marks by which the steel can be traced to the cast from which it has been made. Such marking shall be made at the extreme end of each flat. Steel designation shall also be marked.

16.2 The flat shall also bear identification grooves as shown in Fig. 1.

Steel Grade	'Z' in mm (Approx)	Remark
Gr 1	—	Plain without Grooves
Gr 2	25	Two Grooves 25 mm apart
Gr 3	35	Two Grooves 35 mm apart
Gr 4	45	Two Grooves 45 mm apart

NOTE — In case of rib and groove sections, the identification grooves shall be in the rib side.

16.3 The flat may also be marked with the Standards Mark. Details available with Bureau of Indian Standards.

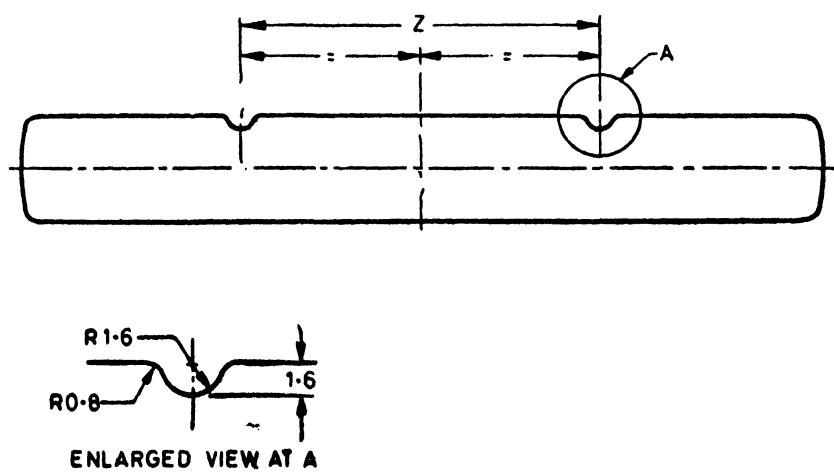


FIG. 1 GROOVES ILLUSTRATION OF IDENTIFICATION

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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